The Journal of Orthopaedics

Research Article

The best way to treat radioulnar synostosis complying with trauma.

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Received : October 18, 2023
Accepted: October 19, 2023
Published : November 22, 2023

Abstract

After forearm or elbow injuries, post-traumatic radioulnar synostosis is an uncommon consequence that can cause severe impairment and loss of motion. Aspects of the primary trauma and the surgical management of that trauma are considered risk factors. The standard of care for synostosis is surgical intervention, which is based on where the bony bridge is located. Surgery should be performed between six months and two years, however more recently, six to twelve months after radiographs show bone maturation—early enough to avoid additional stiffness and contractures—have been advocated. It is recommended to do surgical resection with interposition graft for the majority of synostosis types. There is currently disagreement on whether of the several material types—synthetic, allograft, vascularized, and non-vascularized—isWhile adjuvant therapy is not thought to be required in every situation, it can be helpful for patients who have high risk factors including traumatic brain injury or recurrence. Early postoperative rehabilitation is necessary to preserve range of motion.

Keywords : *radioulnar synostosis, forearm fracture, rotatory forearm motion, heterotopic bone forearm*

INTRODUCTION

An uncommon consequence following forearm and elbow fractures is post-traumatic radioulnar synostosis.1. Anywhere along the forearm might experience synostosis, which impairs function and causes loss of forearm rotation. It can happen following both non-surgical and surgical care. According to reports, the incidence of one or both forearm bone fractures treated with open reduction and internal fixation with plating ranges from 0 to 9.4% of patients.2–5. High levels of soft tissue damage, comminuted fractures, fractures of both bones at the same level, Monteggia fractures, delayed surgery, traumatic brain injury, and extended immobilisation with delayed rehabilitation are risk factors.2-4, 6–9 There might be a correlation with open fractures, but this could just be the result of the severity of the soft tissue damage.The main causes of this are iatrogenic soft tissue trauma, bone grafts or hardware placed in the interosseous area, and surgical techniques that damage the interosseous membrane.

Enhancement of the first course of treatment

A synostosis may arise for a variety of reasons, and minimising the likelihood of development can be achieved by optimising initial treatment. It is best to treat both bone fractures surgically with two incisions made in a fair amount of time.4 It is best to prevent interosseous membrane damage.10, 11 All bone fragments and bone graft should be carefully removed from the interosseous area. It is important to use screws or fixator pins of the proper length so that they do not protrude into the interosseous space or pierce the opposing bone.

Grouping

Vince and Miller4 used the anatomic location of the synostosis over the length of the forearm (Figure 1) to establish an initial classification. Type I was characterised by a synostosis in the ulna and radius's distal intra-articular region. In the forearm, type II was found in the middle third, type III in the proximal third. Later, Jupiter and Ring5 changed this classification by dividing the proximal third synostosis into distinct categories. Type IIIB is located at the radial head, and type IIIA is located at or distal to the bicipital tuberosity. Heterotopic bone from the elbow or distal humerus continues as type IIIC. These divisions are helpful in directing surgical techniques.

Management

The most effective way to improve forearm rotation and

function is through surgery, especially for patients who have an intolerable functional loss of motion. The patient's ability to commit to post-operative therapy is crucial. In Figure 2, a case example is displayed. Patients who can move freely, low-demand patients with significant comorbidities who cannot bear more treatments, and patients who cannot bear the dangers associated with surgery are the only candidates for conservative care.9.

When to get surgery

The best time to have surgery is a topic of debate. There are a number of recommendations based on serum alkaline phosphatase levels, radiographic imaging, and bone scans, but none are regarded as the gold standard. Given the significant risk of recurrence, early surgery should be avoided; yet, thereThere are reports of successful surgeries performed before six months.13, 14, but between six months and two years is generally agreed upon.1, 4, 8, 15, and 16 In the past, the best outcomes happen when the bone matures, which usually happens one to two years after the damage.4,8 According to more recent studies, if resection is carried out in individuals who have radiographic bony maturation, it produces satisfactory overall results without increasing the chance of recurrence.5, 13, 15, 26, Preventing soft tissue contractures and restoring joint motion earlier are two additional benefits of early resection in these individuals.

surgical alternatives according to categorization

The location-based classification aids in directing the general course of care. This treatment summary was described by Hastings and Graham17 (Figure 3). Type I can be managed using the Sauvé-Kapandji technique. if there are degenerative alterations at the distal radioulnar joint (DRUJ), synostosis is under the pronator quadratus, and if the Darrach operation is at the DRUJ. Treatment for types II and IIIA often consists of removing the synostosis, either with or without the implantation of an interposition graft. Radial head replacement or excision is one treatment option for type IIIB. Arthroplasty is one treatment option for Type IIIC.

Resection either with or without a middleman

The goal of treatment for type II and IIIA synostosis is total surgical resection. It is still debatable whether biologic or synthetic interposition materials should be used. The majority of papers are brief case studies or cohort studies that describe different surgical approaches and their successful outcomes. Interposition is believed to minimise and prevent creation of scars. Artificial (silicone, polyethylene, bone wax), allograft (muscle, fascia), and vascularized and non-vascularized autogenous material (fascia lata, adipofascial flaps) are some of the alternatives for interposition.1, 5, 8, 9, 16, 18, and 20 During the actual procedure, the synostosis is completely removed, and the graft is then placed around the ulna or radius and fastened with absorbable sutures. The majority of reports with a range of methods and resources have produced positive outcomes. Jupiter and Ring5 reported 10 instances without interposition and eight cases treated with free fat flap. Adjuvant treatment was not mentioned. The outcomes were functionally equal.

Three patients were treated with vascularized anconeus muscle interposition in a series presented by Bell and Benger18. Prono-supination data at follow-up showed arcs of 100°, 110°, and 150°. Tchang and Yong-Hing, 21 KawaguchiA case of a vascularized fat flap from the distal third of the forearm with 10° of pronation and 55° of supination at a year was described by Sugimoto et al. in their study. Sonderegger et al. (2019) documented a series of seven patients with a range of motion (ROM) of 70° pronation and 70° supination who had a vascularized adipofascial flap. Due to donor site morbidity, Friedrich et al. (2016) reported using fascia lata graft in 13 patients, although allograft was preferred. There were two good, two moderate, and nine exceptional results at the 30-month follow-up.

A set of 20 synostosis, 12 of which were treated with interposition, was provided by Failla et al8. Of those treated, silicone gum leaf was applied to eight; muscle, fat, fascia, polyethylene, andFour cases had great results, three had acceptable results, four had moderate results, and nine had bad results. Overall, the results showed that the use of biologic interposition material produced mediocre to bad results; still, it was more advantageous to utilise interpositional material than solitary resection.

Two patients treated with interposition with allogenic fascia lata graft were recently published by Pfanner et al. (26), showing complete restoration of range of motion and no recurrence after two years. In individuals for whom it is not feasible to remove the proximal synostosis, Kamineni et al.27 reported a method in which a pseudoarthrosis is created by crossing the synostosis and excising 1 cm of the radial shaft. Out of those patients, one was fair, four were good, and two were superb.

In conclusion, opinions on the usefulness of interposition after

synostosis excision and the kind of material to be utilised are inconclusive. There is never any interposition material used by the senior author. On the other hand, fascia lata allografts are generally preferred for interposition grafts when they are necessary since they yield satisfactory results.

Adjuvant therapy

Another option for preventatively treating heterotopic bone loss is to combine adjuvant therapy with preventive treatment techniques. The majority of the advantages of adjuvant therapy, such as low-dose radiation and non-steroidal anti-inflammatory medications (NSAIDs), have been documented in the prevention of heterotopic hip bone growth. Only a small number of studies, meanwhile, have shown how they can prevent the recurrence of radioulnar synostosis.

However, there is little evidence that bisphosphonates are effective in avoiding calcification in total hip replacements (THR).28 Numerous studies have demonstrated the efficacy of indomethacin at a dose of roughly 75 mg per day (25 mg three times per day) in avoiding heterotopic ossification in the hip following total hip replacement.29–32 For patients with synostosis, there has been some meagre data to support its use. like the patient in the Lytle et al.33 case report, who received treatment with indomethacin and a dermal silicone sheet implant. One year after surgery, the patient exhibited complete pronation and nearly normal supination with no recurrence. Two instances treated with fascia lata allograft and excision were reported by Pfanner et al. (26), who also prescribed Celebrex for two months after surgery. At two years, they claimed complete recovery and no recurrence. However, some do believe that indomethacin has been demonstrated in animal studies to impede fracture healing throughout the post-traumatic period,34,35 making it less favourable for acute prevention. Furthermore, only two of the fifteen patients in Viola and Hanel's study on elbow stiffness really took their prescription.

It ultimately had little bearing on the result. Low-dose radiation has demonstrated efficacy in averting calcification following total hip replacement, and it has demonstrated positive outcomes in averting synostosis recurrence. Cullen et al.37 described a group of four patients who underwent a single 800-cGy radiation treatment four days after resection and experienced neither problems nor recurrence. Two examples were described by Abrams et al. 38; one patient received 700 cGy in a single dose, and the other received 1000 cGy overall, divided into four daily treatments. After 21 and 43 months, respectively, neither patient experienced a recurrence. Radiation-induced sarcoma is the most worrisome risk associated with radiation treatment and should beIt is still not advised to use indomethacin or radiotherapy on a regular basis in every situation. Most think it's helpful for those who are highly likely to experience a recurrence. As a result, each patient should receive treatment with NSAIDs or radiation therapy according to their unique needs.

Rehabilitating

While everyone agrees that early and rigorous rehabilitation is essential, no specific approach has gained universal acceptance.9. In order to preserve mobility, bracing can be applied either right away to preserve motion or one or two weeks after surgery. Friedrich et al. (2016) advised static splinting in complete supination for the first two weeks, alternating between maximal pronation and supination at night. During the day, the elbow should be at 90° and the wrist should be stretched at 30°. For range-of-motion exercises on the first postoperative day, Hanel et al.40 suggest using a removable splint with the elbow at 90° and the wrist in neutral, with the splint being removed every hour. then, during the first week following surgery, switching to a wrist-only splint.

Recurrence

After primary resection, the probability of recurrence is reported to range from 6 to 35%; those with substantial soft tissue injury and concomitant head injuries are more likely to experience this risk.4, 5, 8 Patients should be fully informed that there is always a chance of recurrence following any type of surgery. Other preventive measures should be taken into consideration if the patient has high-risk characteristics, such as a history of head trauma, heterotopic ossification, or multiple recurrences.

Experience of the authors

Twenty-three patients in our series had follow-up visits longer than a year. The patients received no interposition graft treatment or free fat flaps. The outcomes corroborate those of Jupiter and Ring5, who used the identical two procedures and reported a favourable outcome in 17/18 of their patients. Initially employed in our series, free fat flaps were subsequently dropped in favour of no interposition material.

Following surgery, 87% of the patients were able to restore and maintain 75% of their rotatory motion. The traditional guidelines of alkaline phosphatase readings, silent bone scans, and bone trabecular maturity have been replaced by an earlier intervention when soft tissues are stable, fracture repair has occurred, and neurologic state is intact.

Conclusion

A rare consequence of forearm or elbow injuries is post-traumatic radioulnar synostosis. Usually, it causes severe impairment due to lack of pronation and supination action. The majority of treatment in the literature is level IV, with case reports and limited cohort studies. The classification based on location establishes surgical intervention as the standard of therapy. It is advised to have surgery 4-6 months later to allow for synostosis bone development. Surgical resection combined with an implant graft is advised for type II and type IIIA, albeit the sort of graft material to be employed is up for debate. The early intervention method without the use of interpositional material is the authors' preferred approach. While adjuvant therapy is not thought to be required in every situation, it can be helpful for individuals with

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